

Dry Rot of Corn



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DRY ROT OF CORN

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Germination tests of thousands of samples of the seed corn on Iowa farms indicate that a large percentage of it is unfit to plant, due to the various corn ear molds which were so common last fall, and principally to the dry rot of corn. It is important that seed corn be carefully examined and selected this spring, and then tested. Some of the diseased ears can be detected by examination alone, but not all. It is essential also to use the germination test to be wholly sure of good seed.

Moldy corn was common in fields thruout the state last fall. In the central and eastern counties, from 2 to 15 percent of the ears were left in the field because of the mold, while many partially diseased ears found their way into the seed corn. The corn grower has already taken his loss incurred in the corn harvest, but the loss due to poor seed is still to follow.

DRY ROT IS ENCOURAGED BY HIGH TEMPERATURE AND RAINFALL

The greatest damage from dry rot was in the central and eastern sections of the state, where the percentage of dry rot ranged from 5 to 20 percent when the corn was husked. To the north and south, less of the disease was found, this being also true of the northwestern portion of the state. Sixty-five samples of ten-ear lots collected in the

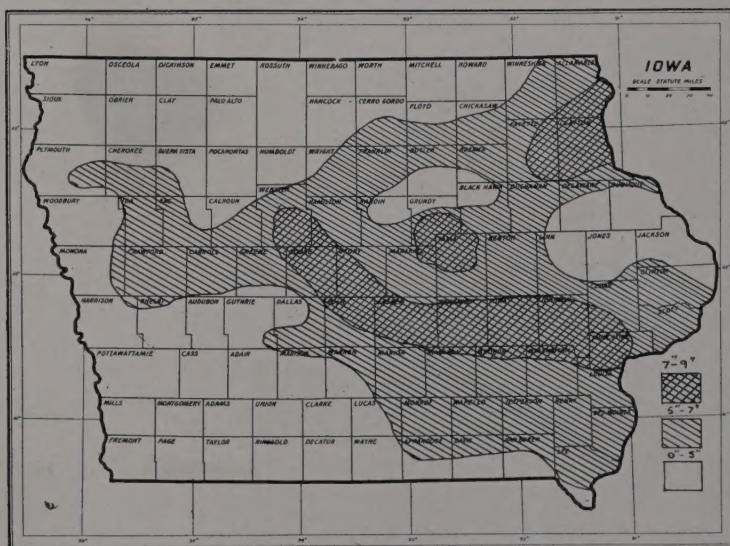


FIG. 1. Map of Iowa showing rainfall distribution in August, 1921. The areas of greatest dry rot are in general the same as those of greatest rainfall. Parts of the state with less than 5 inches of rainfall in August were relatively free from dry rot.



FIG. 2. Dry rot fruiting on corn stalk joint.



FIG. 3. Dry rot extending inside stalk up and down from joint.

central and eastern sections and tested for germination, showed 11 percent of the ears infected with dry rot. Tests of 5,100 seed ears of 100-ear lots, collected in six counties representing all sections of the state, showed 11.5 percent infected with dry rot and unfit for seed. The amount of dry rot in various sections of the state seemed to increase as the rainfall increased. The map of Iowa in Fig. 1 shows this interesting correlation. It gives areas of greatest rainfall during the later part of the growing period of 1921. These same areas showed the greatest amount of dry rot, while the areas of low rainfall had much less. The dry rot fungus flourishes only when the rainfall and temperature are high. The corn crop of 1907, when rainfall was heavy, was badly infected with dry rot, according to published reports. In 1915 there was little dry rot, altho it was a wet season. The fungus was held in check by the low temperature that prevailed, 1915 being a very cool season. In 1921 there was a comparatively high rainfall in the central and eastern part of the state in August and September, accompanied by hot weather conditions which were almost ideal for the growth and destructive activity of the dry rot fungus on all parts of the corn plant.

SIGNS OF DRY ROT

Dry rot of corn attacks all parts of the corn plant, roots, stalks, shanks and ears. The roots of seedlings growing over old dry rot infected stalks or stubble may become infected in this way and fail to mature a full crop or die entirely. In either case a dark brown discoloration of the roots occurs. The rot may progress until the plant is entirely eaten off. On the stalks it attacks chiefly the nodes or joints,

which it discolors. At the end of the season it may be seen on the surface, fruiting as minute black specks. (Fig. 2.)

The shanks of the ears also suffer. In such cases they break over, interfering with the filling and maturing of the ear. In some cases the fungus travels in the shank up into the butt of the ear. The fungus may also attack the tip, entering with the silk. In other instances where an ear stands upright, the husks catch and hold the spores and enough water to start the mold around the butt of the ear or along one side. (Fig. 4.)

The fungus travels freely in the cob, where it usually causes a brown discoloration, but sometimes the signs are not noticeable. Where an ear is infected, the kernels are either dead or injured so seriously that they germinate poorly. Such corn makes poor seed and should be used for feed.

The most common point of attack, however, is at the nodes. Here infection takes place as follows: As the corn stalk reaches its largest growth, the lower leaf sheaths become loosened and spores of the dry rot fungus lodge on the leaves and wash or drop down between the leaf sheath and stalks and attack the corn node.



FIG. 4. Shank and butt of ear with dry rot fruiting on shank and growing as a white felt on the butt kernels.

There is no consistent evidence that the dry rot fungus travels from the soil up to the ears inside the stalk. In studies made last fall, 39 percent of the infected ears were borne on healthy stalks. Only 22 percent of the infected stalks showed dry rot fungus as high as the third node from the ground. Furthermore, only 31 percent of the internodes have been found attacked and in the majority of such cases it was clear that the infection spread each way from the nodes, as shown in Fig. 3. As far as is known, the dry rot fungus attacks only field and

sweet corn and no other plant. It will not spread from ear to ear in a dry crib. It grows at any temperature between 40° and 90° F., but prefers 80° to 86° F., as shown in Fig. 5. When corn is dried, the dry rot fungus lies dormant, but will grow when moisture is supplied.

SEED CORN GERMINATION

Germination tests are necessary to detect and reject seed ears injured by dry rot and other molds. It is not uncommon to find that the best, as well as the poorest looking seed ears are diseased and unfit for seed. Tests made on 6,000 seed ears from 20 counties showed that on an average 11 percent are unfit to plant, due to molds, chiefly dry rot fungus. Many of these ears looked good and no signs of dry rot could be detected in them. There is no way known of culling out the diseased ears with any certainty, except by the germination test.

There are many types of germinators, most of which will give satisfactory results from the standpoint of dead kernels on an ear, but only a few permit the reading of the diseased condition and its cause. To detect the diseased ears and the cause of the disease, the kernels must be placed some distance apart and so protected from one another that the molds that caused the disease cannot spread to adjoining kernels, thus giving misleading results. The materials making up a germinator must be such as to permit sterilization after each time the germinator is used. Otherwise, the spores of the dry rot fungus can live on the germinator and develop on the seed in the next trial. The whole germinator must be of simple construction, inexpensive and adapted to show the strength of the seed germ, the presence of diseased kernels, and the cause of the disease.

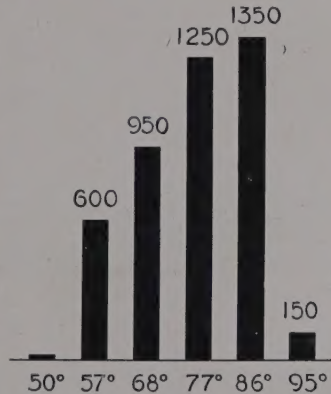


FIG. 5. The growth of dry rot at different temperatures is shown by the columns, the comparison being made on the basis of the weight of the dry rot fungus in culture.

THE RAG DOLL GERMINATOR

The ordinary rag doll germinator, which is so widely known, gives excellent results in the ordinary tests for germinating strength. It consists of a strip of muslin about a foot wide and five feet long, marked into three-inch or four-inch squares running along the center of the cloth, from end to end.

The muslin is soaked in boiling water and smoothed out, and the squares are then numbered. From each ear to be tested, eight kernels are taken and laid in one of the squares, and the ear numbered to correspond with the number of the square. When the squares have all been filled, the cloth is firmly rolled up and the ends of the roll tied securely. Then the "doll" is put into a pail or other container and covered so that it will keep moist. It is held here for from five to eight days at a little above room temperature and then it is ready to "read."

This ordinary rag doll tester is open to some objections in testing diseased corn, because it does not prevent molds from spreading from diseased kernels to healthy kernels during the test.

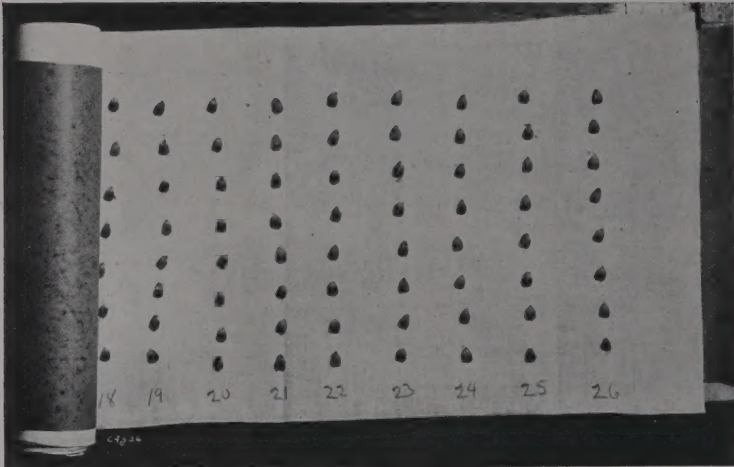


FIG. 6. This is the modified rag doll tester, made of muslin and of glazed butcher's wrapping paper.

MODIFIED RAG DOLL GERMINATOR

What may be called the "modified rag doll germinator" is more satisfactory. It consists of a strip of glazed butcher's paper, nine inches wide and six feet long, and a strip of good quality bleached muslin of the same size laid together. The paper is used to prevent the promiscuous spread of the molds. The cloth is boiled in water and laid on top of the paper, as shown in Fig. 6. The kernels are laid in the germinator in rows across the cloth, with the germ side next the wet cloth and with the tips all pointing one way, the rows are numbered at the margin of the cloth as in the ordinary and well-known rag doll, and the ears are numbered to correspond. When the corn is in place, the tester is rolled, tied and placed on end in a tub or large pail containing about one quart of water. A moist gunny sack may be placed over the ends of the "dolls" and another tub or pail turned over the wet sack to prevent drying out. The "dolls" must be kept wet and at a temperature of 80° to 85° F. At this temperature the molds and corn germinate rapidly. At lower temperatures, neither the corn nor the dry rot fungus grow as well and it is not possible to determine whether the seed is infected.

The rag doll germinator, altho very simple and convenient, has certain limitations, as already suggested. The most serious one of these is the short distance between the kernels in the doll. The molds sometimes do spread from an infected to a healthy kernel and show misleading results. Some molds, and especially the dry rot fungus, can grow thru the cloth and paper and cause mold on some kernels otherwise healthy. Again, the development of the molds cannot be observed until the dolls are opened to be read.

GLASS TOP SAND-BOX GERMINATOR

The sand-box germinator, tho somewhat more expensive, does not have these shortcomings. It is merely a long wooden box 8 to 12 feet long by two to three feet wide and four inches deep, supported on legs raised to a convenient working height. The bottom of this box is made of narrow strips to prevent warping. The bottom is covered

with a clean, wet cloth, and filled within an inch of top with clean wet sand. Another wet strip of muslin is laid on top of the sand and the corn laid in rows, eight from each ear, allowing one square inch for each kernel. (Fig. 7.) Such a germinator will permit the testing of about five and one-half bushels every five to nine days.

Panes of glass of any convenient or available size are laid over the corn and the whole germinator covered with dry sacks or other thick materials, well tucked in at the edges of the frame. The glass holds the moisture on the corn and enables one to follow developments daily.

The greatest advantage of the sand-box tester is the distance between the kernels, which prevents the molds on diseased kernels from infecting healthy kernels. The square-inch space allowed each kernel is usually enough to hold the fungous growth until the germinator is ready to read. If a very active mold is present, it can easily be seen whether a moldy kernel is of itself moldy or whether the mold has spread from adjoining kernels.

All cloths must be scalded in boiling water before using and fresh, clean sand must be used. If new sand is not available for each trial, it may also be scalded or oven-baked. The wet sand holds sufficient moisture to carry the germination test thru, if the glass is firmly placed against the border of the box. The cloth over the sand keeps the roots from growing into the sand; they will stay on top of the cloth, unless held too long, and can be easily examined.

From the standpoint of a critical study of seed corn germination, the glass topped sand-box is recommended, but the modified rag doll type has its advantages as to compactness, convenience and adaptability to most farm conditions. The glass topped sand-box type is recommended only as a substitute for the modified rag doll, where a man has a warm room (as a furnace room), and is especially interested in making an unusually careful study of his corn. When the temperature of the room is held between 80° and 86° F., the corn will be ready to read in five to ten days. At lower temperatures, a longer time will be necessary. It is well to allow sufficient time for the roots and shoots to grow out three inches in length (Fig. 8); otherwise, the starchy kernels which take up water and start to germinate more quickly than the harder kernels will appear the strongest, whereas the harder, horny kernels may be equally or even more vigorous, but slow in starting.

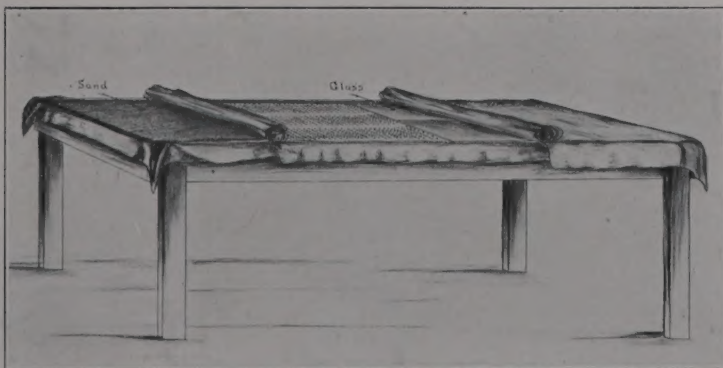


FIG. 7. The sand-box tester, which may be quite readily built on the farm.

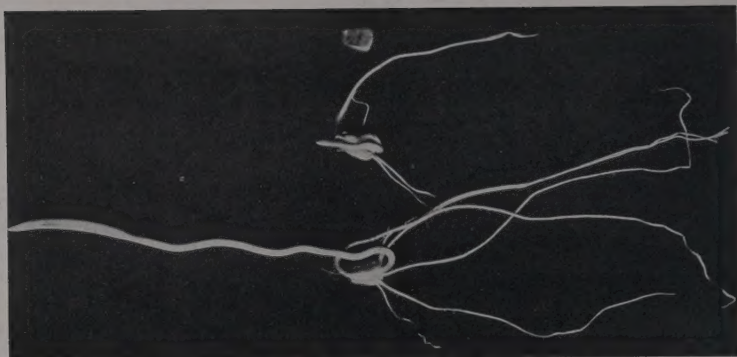


FIG. 8. Strong, weak and dead kernels as seen in the germinator.

THE LIFE HISTORY OF THE CORN DRY ROT FUNGUS

The dry rot fungus, scientifically known as *Diplodia zeae*, is a creamy white mold that occurs in and on the stalk and the kernels or on the husk of badly diseased ears. Its activity is carried on chiefly inside the corn plant and only comes to the surface to produce its spores. These are borne in very small black chambers, about the size of a mustard seed, on the joints of the stalk or on the husk, cob, or kernels, where they are very easily seen. The spores are very small, light brown and only visible with a microscope. They are so small and light that they can easily be carried long distances by wind or water. They can live on old stubble for at least three years, and possibly longer, and be able to attack corn under favorable conditions for their growth. These spores germinate only in water between 40° to 90° F. The most suitable temperature is about 80° F.

Various molds are found on germinating corn, other than the dry rot fungus. The kernels are often attacked by the common molds, such as bread mold, and by various black, yellow and green molds that are common on moldy fruit and vegetables or any other food substance. They usually attack the kernel thru some crack, as a broken tip, or where the kernel was scratched when removed from the ear. These molds in many cases injure the germination or kill the young shoot and roots. Unless the percentage is high, do not discard the ear.

Another class of molds found on corn is the so-called fusarium molds. They are usually white or pink, spreading in all directions from an infected kernel. Ears that have been injured in any way, as by worms, insects, birds and other agencies, are very frequently infected. This past season the fusarium molds were not as prevalent as the dry rot fungus. They were most prevalent in western and southwestern Iowa. Some of the fusarium molds may enter the ear in much the same way as the dry rot fungus and kill the kernels in a like manner.

HOW TO SELECT SEED CORN TO AVOID MOLDS

Do not wait until just before frost to select seed corn. Select the ears as soon as well dented. The molds attacking corn do their greatest damage to the ears late in the season, especially if there is much rain. Seed corn selected as soon as well filled and dented and hung up to dry in a well-aired place is less liable to become contaminated.

The early selection of seed also enables one to better judge the parent plant. Seed ears should be only selected from green standing stalks with sound shanks, free from smut, dead, spotted or striped leaves, or other abnormalities.